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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	Steven D. Jensen and Dan E. Fischer, D.D.S.)	
)	
)	
)	Art Unit
Serial No.	Not Yet Assigned)	1619
)	
Filed:	November 9, 2000)	
)	
For:	COMPOSITIONS AND METHODS FOR WHITENING AND DESSENSITIZING TEETH)	
)	
Examiner:	Raj Bawa, Ph.D.)	

Box: PATENT APPLICATION
Assistant Commissioner for Patents
Washington, DC 20231

TRANSMITTAL FOR CIP PATENT APPLICATION

Sir:

Transmitted herewith for filing under 37 C.F.R. § 1.53(b) is a patent application which is a continuation-in-part (CIP) of copending prior application Serial No. 09/694,516; which is a continuation-in-part (CIP) of copending prior application Serial No. 09/190,709; the present application which is also a continuation-in-part (CIP) of copending prior application Serial No. 19/494,113.

The present application is entitled COMPOSITIONS AND METHODS FOR WHITENING AND DESENSITIZING TEETH and is filed in the name of the following inventor(s): Steven D. Jensen and Dan E. Fischer, D.D.S.

Enclosed are the following:

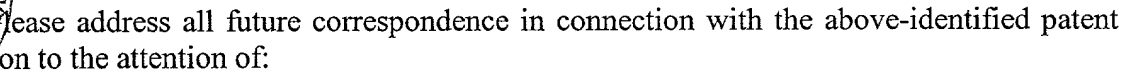
- X A specification, claims, abstract, and cover page in total comprising thirty-seven (37) pages.
- X Five (5) sheets of formal drawings.
- X A joint signature Declaration, Power of Attorney and Petition.
- X An Assignment conveying the invention to Ultradent Products, Inc., including a Form PTO-1595 recordation cover sheet.
- X A Certificate of Mailing by "Express Mail" certifying a filing date by use of Express Mail Label No. EL675130955US.
- X Priority to United States Patent Application Serial Nos. 09/694,516, 09/190,709 and 09/494,113 is claimed under 35 U.S.C. § 120.

The filing fee has been calculated as shown below.

			SMALL ENTITY		LARGE ENTITY	
FOR	NO. FILED	NO. EXTRA	RATE	FEE	RATE	FEE
BASIC FEE				\$355		\$710.00
TOT. CLAIMS	20 -20=	0	X 9=	0	X 18=	
IND. CLAIMS	3 -3=	0	X 40	0	X 80=	
MULTIPLE DEPENDENT CLAIM			+135=	0	+270=	
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- X Check No. 118108 in the amount of \$710.00 is enclosed to cover the filing fee.
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- X The Commissioner is hereby authorized to charge payment of or credit any overpayment of fees to Deposit Account No. 23-3178. A duplicate copy of this letter is enclosed.

~~Page 3~~



Dated this 10th day of November 2000.


John M. Gynn

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1 excessively translucent teeth, may result in increased tooth sensitivity, which can become
2 quite severe for some people.

3 From the foregoing, it will be appreciated that what is needed in the art are improved
4 compositions and methods for whitening teeth, including improved compositions and
5 methods for opacifying translucent teeth.

6 It will also be appreciated that what is also needed are improved compositions and
7 methods for whitening and opacifying teeth which reduce tooth sensitivity, compared to
8 conventional dental bleaching compositions.

9 Such compositions and methods for bleaching, whitening and opacifying teeth, while
10 reducing tooth sensitivity, are disclosed and claimed herein.

11

1 The compositions are preferably used with a dental tray that is thin-walled, flexible
2 and lightweight. Preferred dental trays should be adapted for maximum comfort and will
3 exert little, if any, significant mechanical pressure onto the person's teeth or gums. When
4 using a tray of this nature, the tooth whitening compositions of the present invention will
5 preferably be sufficiently sticky, viscous and resistant to dilution by saliva so as to act as a
6 glue-like material and reliably adhere and retain the dental tray over the person's teeth for
7 a desired time duration. Although such dental trays are preferred, any conventional dental
8 trays may also be utilized. The inventive dental compositions may also be applied directly
9 to a person's teeth without using a tray. In such cases, higher concentrations of the active
10 bleaching agents will preferably be used in order to speed up the desired bleaching action.

11 Any component other than the active dental agents, such as the potassium nitrate,
12 bleaching agent, antimicrobial agent and anticariogenic agent, shall comprise the "carrier".
13 In the case where the dental composition is sticky and viscous, the carrier will constitute a
14 sticky matrix material formed by combining a sufficient quantity of a tackifying agent, such
15 as carboxypolymethylene, with one or more solvents, such as glycerin, polyethylene glycol,
16 or water. Although the carrier is preferably formed by combining a tackifying agent and a
17 solvent, the carrier may comprise a solvent without a tackifying agent in some embodiments.
18 Preferred compositions, as described hereinbelow, are relatively sticky and glue-like to
19 enable a preferred dental tray to be held and retained against a person's teeth. Preferred
20 carriers are preferably safe for oral use, do not readily dissolve in saliva, and do not react
21 with the tooth opacifying agent.

22 In addition to carboxypolymethylene, examples of other suitable tackifying agents,
23 or thickening agents that can assist other tackifying agents, include xanthan gum, talha gum,
24 tragacanth gum, carboxymethylcellulose, locust bean gum, guar gum, Irish moss gum, ghatti
25 gum, furcelleran gum, carrageenan gum, arabic gum, alginic acid gum, agar gum, alginate
26 gum, proteins, such as collagen, PEMULEN®, a proprietary compound of B.F. Goodrich,

1 POLYOX®, a mixture of polyethylene oxides having a molecular weight of 100,000-
2 8,000,000 and available from Union Carbide, including higher molecular weight
3 polyethylene glycols, or any compositional or chemical equivalents of the foregoing.
4 PEMULEN® is a propriety formula that includes a significant quantity of a polyacrylic
5 copolymer that has a slightly hydrophobic end and a strongly hydrophilic end.

6 In addition to glycerin, many other polyols may serve as suitable solvents. The
7 solvent may also be water alone or in combination with a polyol. Glycerin is a preferred
8 solvent as it works well in forming a sticky gel with carboxypolymethylene. Glycerin also
9 provides some flavor enhancement. A few possible substitutes for glycerin include
10 propylene glycols, polypropylene glycol, polyethylene glycols, erythritol, sorbitol, mannitol,
11 other polyols, and the like. In some embodiments polyols such as glycerin, lower molecular
12 weight polyethylene glycols, polypropylene glycol, propylene glycol, and sorbitol may also
13 be used without a tackifying agent.

14 As indicated hereinabove, one currently preferred sticky matrix material includes a
15 mixture of carboxypolymethylene together with other suitable admixtures. The term
16 “carboxypolymethylene” is used to denote a broad category of polymers, particularly
17 copolymers of acrylic acid and polyallyl sucrose. Because carboxypolymethylene that has
18 not been completely neutralized includes active carboxylic acid groups or moieties,
19 carboxypolymethylene can be classified as a weak acid. When dispersed in water,
20 carboxypolymethylene can have a pH as low as about 2.5.

21 Because highly acidic compositions can etch teeth, it is generally preferable to adjust
22 the pH of dental compositions that include carboxypolymethylene or other acids to make
23 them less acidic. Accordingly, it is preferable to adjust the pH of the bleaching compositions
24 to within a range from about 4 to about 9, more preferably to within a range from about 5 to
25 about 8. Because it is contemplated that the carboxypolymethylene used in the matrix
26 material and the compositions of the present invention will be mixed with a base to raise the

1 An improved dental tray that is thin-walled, flexible and lightweight for holding the
2 dental composition adjacent to a person's teeth is preferably used in combination with sticky
3 and viscous dental whitening compositions of the present invention. The general process for
4 preparing such dental trays is as follows. First, an alginate impression which registers all
5 teeth surfaces plus the gingival margin is made and a stone cast is made of the impression.
6 Optional reservoirs can be prepared by building a layer of rigid material on the stone cast on
7 specific teeth surfaces to be treated. A dental tray is then vacuum formed from the modified
8 cast using a thin, flexible plastic sheet material. Once formed, the tray is preferably trimmed
9 barely shy of the gingival margin on both the buccal and lingual surfaces of the person's
10 teeth. The resulting tray provides a comfortable fit of the person's teeth, with optional
11 reservoirs or spaces located where the rigid material was placed on the stone cast. The trays
12 can optionally overlap the gums if desired to provide contact between the dental
13 compositions and a person's gums. The trays of the present invention have greatly increased
14 comfort and exert little or no significant mechanical pressure on a person's teeth or gums.
15 Instead, sticky dental compositions within the scope of the invention can act like a glue to
16 hold the improved trays in place.

17 The amount of tooth whitening obtained through the use of the inventive
18 compositions and methods is dependent primarily upon (1) the length of time each day the
19 tray is worn; and (2) the number of days the tray is worn. The treatment schedule may be
20 tailored to each person's lifestyle or response to the treatment and can be performed as often
21 as a person desires to provide effective relief from excessively translucent teeth. It has been
22 found that treatment during sleep is a good treatment period since there is less mouth activity
23 which causes less whitening composition to be pumped from the tray.

24 In short, the desensitizing bleaching compositions according to the invention include
25 a dental bleaching agent (*e.g.*, carbamide peroxide) in an amount so as to effect bleaching of
26 a person's teeth, typically by maintaining the dental composition in contact with the person's

teeth for at least about 15 minutes, more preferably for at least about 1 hour. They also include potassium nitrate in an amount so as to both reduce sensitivity that may be caused by contacting the dental bleaching agent with a person's teeth and also to enhance the whitening effect of the dental bleaching agent. By means of a comparative study discussed below, the inventors discovered the surprising and unexpected result that the desensitization and enhanced whitening properties of potassium nitrate are actually higher when included in lower concentrations (*e.g.*, 0.5%) rather than at higher concentrations (*e.g.*, 3%).

Moreover, the compositions of the present invention should be contrasted with conventional desensitizing tooth paste compositions formulated with large quantities of abrasives (*e.g.*, 20% or more by weight) and high concentrations of potassium nitrate (*e.g.*, up to 10% by weight) which are intended to contact the teeth during daily brushing (typically for 60 seconds or less). Such compositions are formulated to treat past, rather than prospective, tooth sensitivity. They do not treat sensitivity caused by simultaneous contact of the teeth with a dental bleaching agent, particularly since no significant bleaching and sensitization of a person's teeth are likely using peroxide-containing toothpastes due to the extremely short contact times.

Accordingly, an object of the present invention is to provide improved compositions and methods for whitening teeth, including compositions and methods for opacifying excessively translucent teeth.

It is another object to provide compositions for whitening and opacifying teeth which reduce tooth sensitivity compared to conventional dental bleaching compositions.

These and other objects and features of the present invention will become more fully apparent from the description as follows, or may be learned by the practice of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a stone cast of a person's teeth with a coating being applied to selected teeth surfaces.

Figure 2 is a perspective view of the stone cast of Figure 1 with a dental tray formed from the cast and trimmed below the gingival margin.

Figure 3 is a cross-sectional view taken along line 3-3 of Figure 2.

Figure 3A is an enlarged close-up view taken within the section line 3A-3A of Figure 3.

Figure 4 is a cross-sectional view taken along line 4-4 of Figure 2.

Figure 5 is a perspective view of the opacifying composition being delivered from a syringe into a thin-walled, flexible dental tray.

Figure 6 is a perspective view of a thin-walled, flexible dental tray filled with the opacifying composition just before being positioned on a person's upper arch.

Figure 7 is a perspective view of a thin-walled, flexible dental tray filled with the opacifying composition positioned on a person's upper arch.

1 whitening composition that can itself act as an adhesive in holding a comfortable, non-self-
2 retaining dental tray against a person's teeth. The use of carboxypolymethylene, either alone
3 or in combination with other tackifying agents, eliminates the need to use dental trays that
4 are self-retaining (*i.e.*, typically trays that are rigid, which mechanically interlock over a
5 person's teeth or gums, and which are intended for use with less sticky compositions).

6 Carboxypolymethylene is a broad term that refers to vinyl polymers having active
7 carboxyl groups. Suitable carboxypolymethylene compositions may be obtained from B. F.
8 Goodrich Company under the trade name CARBOPOL®. Another tradename for
9 carboxypolymethylene is CARBOMER®. In a commonly-sold form, carboxypolymethylene
10 can have a pH as low as 2.5. As discussed below, the pH of compositions made with
11 carboxypolymethylene can be raised to yield compositions that are less acidic.

12 One currently preferred carboxypolymethylene resin is known by the tradename
13 CARBOPOL 934P. CARBOPOL 934P is a high purity pharmaceutical grade of
14 CARBOPOL 934, having an approximate molecular weight of about 3,000,000. In addition
15 to thickening and suspending, CARBOPOL 934P has been used in dry tablets to impart
16 sustained release properties. Extensive toxicity studies have been conducted on
17 CARBOPOL 934P, and a master file has been established with the Food and Drug
18 Administration. It is listed as CARBOMER 934P in the National Formulary. A more
19 recently preferred carboxypolymethylene is CARBOPOL 974P NF, which has more recently
20 surpassed CARBOPOL 934P as the carboxypolymethylene of choice. Although
21 CARBOPOL 974P NF is similar or identical in molecular weight compared to CARBOPOL
22 934P, it is purified in a way that makes it more pharmaceutically acceptable material.

23 It is believed that other carboxypolymethylene resins, such as CARBOPOL 940, may
24 be substituted for CARBOPOL 934P or CARBOPOL 974P NF. CARBOPOL 934P and
25 CARBOPOL 974P NF are currently preferred because they are obtainable in a
26 pharmaceutical grade.

1 The amount of carboxypolymethylene within the inventive dental whitening
2 compositions can vary depending on the desired level of stickiness and also the identities and
3 amounts of the other components within the dental composition. In general, the dental
4 whitening/desensitizing compositions of the present invention will preferably include
5 carboxypolymethylene in a concentration in a range from about 0.5% to about 25% by weight
6 of the dental whitening composition, more preferably in a range from about 2% to about 12%
7 and most preferably in a range from about 3% to about 10%. Where is it desired to increase
8 the stickiness, viscosity and resistance to dilution to saliva, one may adjust the concentration
9 of carboxypolymethylene to achieve a desired level of any or all of these properties.
10 Increased stickiness assists in retaining the preferred dental trays against a person's teeth.
11 Alternatively, compositions can be made less adhesive and tacky if desired, particularly is
12 applied directly without a dental tray.

13 It should be understood, however, that the actual amount of carboxypolymethylene
14 is not critical for obtaining a sticky, viscous dental composition. For example, the sticky
15 matrix material may include other tackifying components that in combination with, or in lieu
16 of some or all of, the carboxypolymethylene will yield a dental whitening composition
17 having the desired level of stickiness needed to hold a preferred, comfortable-fitting dental
18 tray in place over a person's teeth. Other synthetic polymers and/or natural gums, proteins,
19 or other gel-forming admixtures can be used so long as they yield a sticky dental whitening
20 composition.

21 In order to obtain good dispersion of the carboxypolymethylene resin within the
22 dental whitening composition, it is recommended that the carboxypolymethylene be mixed
23 with a suitable solvent before attempting to add other components that are less compatible
24 with carboxypolymethylene, such as water. Examples of suitable solvents for use with
25 carboxypolymethylene include glycerin, polyalkylene glycols, other polyols, and the like.
26 Glycerin appears to enable larger quantities of carboxypolymethylene to be dispersed in

1 water. It is preferable that the concentration of glycerin, polyol, or like substance utilized as
2 a solvent in the dental whitening compositions be added in a range from about 15% to about
3 85% by weight of the dental whitening compositions, more preferably in a range from about
4 25% to about 75% by weight, and most preferably in a range from about 30% to about 65%
5 by weight.

6 Glycerin, other polyols, and the like are inexpensive solvents that work well in
7 forming a sticky gel with carboxypolymethylene. The glycerin also provides some flavor
8 enhancement such that a bland, sweet flavor is perceived. A few possible substitutes for
9 glycerin include propylene glycol, polypropylene glycol, polyethylene glycols, sorbitol,
10 mannitol, erythritol, other polyols, stearyl alcohol and other alcohols, and the like. Ethylene
11 glycol would also work but is disfavored since it is toxic. In addition to acting as a solvent
12 for the tackifying and thickening agents, hydrophilic solvents such as glycerin, polyethylene
13 glycols, polypropylene glycol, propylene glycol, and sorbitol may also be used as a suitable
14 carrier without a tackifying agent.

15 Water may also be included as a solvent within the compositions of the present
16 invention, although more carboxypolymethylene or other tackifying agent must generally be
17 included as more water is included in order to maintain the same level of stickiness. The
18 amount of water included within the dental whitening compositions of the present invention
19 is preferably in a range of about 0% to about 50% by weight of the dental whitening
20 composition, more preferably in a range of about 1% to about 45% by weight and most
21 preferably in a range of about 2% to about 40% by weight . It will be appreciated that the
22 total quantity of water in the dental whitening composition may come from different sources.
23 For instance, some constituents such as dental agents and bases discussed below may come
24 as aqueous solutions.

25 Because carboxypolymethylene is a polycarboxylic acid, it tends to lower the pH of
26 the resulting dental whitening compositions significantly, down to a pH of about 2.5 in some

1 dental whitening composition in combination with the other components within the dental
2 whitening composition.

3 In addition to carboxypolymethylene, examples of other suitable tackifying and
4 thickening agents include gums such as xanthan gum, talha gum, tragacanth gum, locust bean
5 gum, guar gum, Irish moss gum, ghatti gum, furcelleran gum, carrageenan gum, arabic gum,
6 alginic acid gum, agar gum, and alginate gum, as well as proteins, such as collagen, or
7 cellulosic ethers. Another suitable tackifying agent is sold as PEMULEN®, a proprietary
8 compound from B.F. Goodrich, or a compositional or chemical equivalent thereof.
9 PEMULEN® includes a significant quantity of a polyacrylic copolymer that has a slightly
10 hydrophobic end and a strongly hydrophilic end. Additional examples of suitable tackifying
11 agents include polyethylene oxides such as POLYOX® sold by Union Carbide. These
12 tackifying agents may be present in the same ranges as discussed above in relation to
13 carboxypolymethylene.

14 Examples of suitable bleaching agents include aqueous hydrogen peroxide,
15 carbamide peroxide, benzoyl peroxide, glyceryl peroxide, percarbonates and perborates of
16 alkali and alkaline earth metals (*e.g.*, sodium perborate) and peroxyacetic acid. A significant
17 advantage of using potassium nitrate as an opacifying agent in combination with a bleaching
18 agent in a tooth whitening composition is that the potassium nitrate simultaneously decreases
19 the sensitivity of the teeth that may result from the use of the bleaching agent. The bleaching
20 agents are preferably included in a range from about 0.5% to about 50% by weight of the
21 dental whitening composition, more preferably in a range from about 1% to about 30% by
22 weight and most preferably in a range from about 3% to about 20% by weight.

23 In order to preserve the stability of the dental whitening compositions, it is often
24 preferable to include an ion scavenger such as EDTA, salts of EDTA such as edetate
25 disodium, oxine EDTA, calcium disodium EDTA, and others. Additionally, ion scavengers
26 such as citric acid, succinic acid, adipic acid, nitrates and phosphates of tin and any other

1 Although not required, sticky and viscous dental whitening compositions of the
2 present invention are preferably used to treat a person's teeth in conjunction with dental trays
3 that exert little or no significant mechanical pressure onto a person's teeth and gums. The
4 result is a more comfortable and pleasant feeling dental tray, unlike prior art dental trays
5 which are generally rigid and/or thick-walled such that they exert sufficient mechanical
6 pressures onto the teeth and/or gums to be "self-retaining".

7 In the general process for preparing preferred dental trays according to the present
8 invention, an alginate impression is made which registers all teeth surfaces plus the gingival
9 margin. Thereafter, a stone cast is made of the impression. Excess stone can be trimmed
10 away for easy manipulation and forming the dental tray.

11 Reference is now made to Figures 1-4. In a preferred method for forming a dental
12 tray, one or more reservoirs can be formed in the resultant dental tray by applying a thin
13 coating 10 of a rigid material to the stone cast 12 corresponding to teeth where it is desired
14 to provide more of the dental whitening composition. As depicted in Figure 1, the coating
15 10 may be applied using a brush tipped applicator 14. The coating may be light curable for
16 convenience. In those instances where the dental tray is to be trimmed below the gingival
17 margin, the coating material will preferably be applied in a manner that is kept at a distance
18 greater than about 1 mm from the gingival line 16 represented on the stone cast, more
19 preferably in a range from about 1.25 to about 1.5 mm from the gingival line 16.

20 The finished coating will have a thickness corresponding to the desired reservoir
21 depth, which will commonly be about 0.5 mm. It is generally preferred that the rigid coating
22 material not be applied over the stone cast corresponding to the incisal edges 18 and occlusal
23 edges 20 of the person's teeth. This because it is preferable for the incisal edges and occlusal
24 edges of the person's actual teeth to contact the finished tray in order to prevent or reduce
25 vertical movement of the tray during use, which movement could act as a pump that could

1 the stickiness of the dental whitening compositions of the present invention, they should not
2 be taken to be a limitation as to the actual length of time that the patient may wish to use the
3 inventive dental whitening compositions. While a given dental whitening composition may
4 be able to retain the dental tray against a person's teeth for, *e.g.*, 10 hours or more, that
5 composition could certainly be used within the scope of the present invention for any desired
6 time period, such as for 15 minutes, one hour, or any desired time duration.

7 The desensitizing dental whitening compositions of the present invention may be
8 used at any time and for any duration by a person that desires to whiten his or her teeth.
9 Although the dental whitening compositions of the present invention facilitate the use of
10 flexible, thin-walled dental trays that are more comfortable to use compared to prior dental
11 trays, the insertion of any dental tray within a person's mouth will cause some alteration of
12 behavior and diminution of the freedom to use one's mouth. Therefore, in order to maximize
13 treatment time and reduce the inconvenience of having a dental tray lodged within a person's
14 mouth, it is recommended to use the dental trays at night during a person's sleep.

15 It has been found that optimal results are achieved from cyclic exposure periods
16 involving repeated exposures over several days or weeks. For example, the treatment regime
17 may alternatively entail exposure for a period of time such as an hour without further
18 exposure until the subsequent day. For day use, it is recommended that the whitening
19 compositions be applied for about 1 to 3 hours. The length of the treatment period during
20 night use may vary with the sleep pattern of the particular person and may accordingly be
21 between about 5 to 9 hours.

22 In order to more clearly illustrate the parameters of the inventive dental whitening
23 compositions within the scope of the present invention, the following examples are
24 presented. The following examples are intended to be exemplary and should not be viewed
25 as limiting to the scope of the invention.
26

EXAMPLE 1

A whitening composition within the scope of the invention was prepared by combining the following ingredients in the following proportions, measured as percentage by weight of the whitening composition:

CARBOPOL 974P NF	6.8%
Glycerin	48.45%
Polyethylene glycol 300	5.5%
Water	20.0%
Sodium hydroxide (50%)	5.4%
KNO ₃	3.0%
Carbamide peroxide	10.5%
Disodium EDTA	0.1%
NaF	0.25%

The CARBOPOL 974P NF was obtained from B.F. Goodrich Company in Cleveland, Ohio. The CARBOPOL 974P NF was first combined with the glycerin and polyethylene glycol 300 then mixed with the water. Mixing glycerin and polyethylene glycol 300 within the CARBOPOL 974P NF enabled it to be more easily mixed with the water. The KNO₃, carbamide peroxide and disodium EDTA were added to the mixture, after which the sodium hydroxide was blended into the homogeneous composition in order to raise the pH to an acceptable level. The sodium fluoride was then added. The resulting dental whitening composition was found to have opacifying, bleaching, desensitizing and anticariogenic properties, and was sufficiently sticky that it could reliably hold and maintain a dental tray against a person's teeth without significant mechanical pressure being exerted by the tray onto a person's teeth and gums.

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Table 1

1	2	3	4	5	6	7	8	9
A	266	37 (13.9)	40 (15)	2 (0.8)	3 (1.1)	14	7	5.4
B	294	51 (17.3)	50 (17)	14 (4.8)	3 (1)	17	6	4.6
C	279	65 (23.3)	45 (16.1)	4 (1.4)	3 (1.1)	17	6	6.7
D	256	61 (23.9)	70 (27.6)	13 (5.1)	2 (0.8)	18	2	7.5
E	216	14 (5.3)	4 (2.1)	0 (0)	0 (0)	7	11	8.6

Column 1 = Composition Tested

Column 2 = Total number of days used by all patients in group

Column 3 = Number of days sensitive to hot or cold (% of total days)

Column 4 = Number of days gums sensitive (% of total days)

Column 5 = Number of days tongue sensitive (% of total days)

Column 6 = Number of days throat sensitive (% of total days)

Column 7 = Number of patients reporting sensitivity to anything

Column 8 = Number of patients reporting no sensitivity to anything

Column 9 = Average number of shade tab changes

As clearly demonstrated by the data set forth in Table 1, the comparative study showed a dramatic decrease for composition E in the number of days that patients experienced hot or cold sensitivity compared compositions A-D. Surprisingly, even though potassium nitrate was heretofore believed to be a desensitizing agent at any concentration, when mixed with a dental bleaching agent at a concentration of 3% (compositions B-D), it actually *increased* patient tooth sensitivity compared to composition A, which included no potassium nitrate. This demonstrated that potassium nitrate, when blended with a dental bleaching agent and used, does not behave as a desensitizing agent but instead increases sensitivity at certain concentrations (e.g. 3%). Even more surprisingly, composition E resulted in an average Vita tab shade change of 8.6, which was even more than any of compositions A-D, including composition D, which included approximately 50% more

bleaching agent than composition E, thus demonstrating the surprising result that including lower concentrations of potassium nitrate increases whitening of teeth compared to compositions that either include no potassium nitrate or those which include 3% potassium nitrate.

EXAMPLES 3-10

Dental whitening compositions within the scope of the present invention are made according to Example 1, except that the concentration of KNO_3 is included in the following amounts: 0.01%, 0.05%, 0.1%, 0.3%, 0.75%, 1%, 1.5% and 2%. The resulting dental bleaching compositions would be expected to have exhibit superior bleaching with less sensitivity compared to dental bleaching compositions that include no potassium nitrate.

EXAMPLE 11

Dental whitening compositions within the scope of the present invention are made according to Example 2, except that at least a portion of the glycerin is replaced by propylene glycol.

EXAMPLE 12

Dental whitening compositions within the scope of the present invention are made according to Example 2, except that the CARBOPOL 974 NF is included in the following amounts: 0%, 0.5%, 2%, 3%, 5%, 10% and 20%. The concentration of NaOH (50%) is adjusted accordingly to maintain approximately the same pH as in Example 2.

EXAMPLE 13

Dental whitening compositions within the scope of the present invention are made according to Example 12, except that all or part of the CARBOPOL 974 NF is replaced by

at least one of the following thickening agents: xanthan gum, Irish moss gum, ghatti gum, furcelleran gum, carrageenan gum, arabic gum, alginic acid gum, agar gum, alginate gum, a tackifying protein, or a cellulosic ether.

EXAMPLE 14

A dental whitening composition within the scope of the present invention is made according to Example 1, except that the ingredients are combined in the following concentrations by weight percent:

Glycerin	89%
KNO ₃	1%
Carbamide peroxide	15%

The foregoing procedure results in a dental whitening composition having similar opacifying and desensitizing capabilities compared to the composition of Example 2. However, the composition is less sticky than the composition of Example 2 and has greater bleaching capability.

17. A dental bleaching composition adapted for whitening and desensitizing a person's teeth without brushing or scrubbing, comprising:

a dental bleaching agent included in an amount so as to have a tooth whitening effect on a person's teeth without brushing or scrubbing the person's teeth with the dental bleaching composition;

potassium nitrate included in an amount of about 0.01% to about 2% by weight of the dental bleaching composition and so as to enhance the tooth whitening effect of the dental bleaching agent and reduce tooth sensitivity that may be caused by the dental bleaching agent when the dental bleaching and desensitizing composition is passively maintained in contact with the person's teeth for a time period of at least about 15 minutes without brushing or scrubbing; and

a carrier that is substantially free of abrasives into which the dental bleaching agent and potassium nitrate are dispersed.

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18. A method for whitening and desensitizing a person's teeth comprising:
providing a dental bleaching composition including:
a dental bleaching agent included in an amount so as to have a tooth
whitening effect when contacted with a person's teeth.
potassium nitrate included in an amount of about 0.01% to about 2%
by weight of the dental bleaching composition and so as to enhance the tooth
whitening effect of the dental bleaching agent and reduce tooth sensitivity
that may be caused by the dental bleaching agent; and
a carrier into which the dental bleaching agent and potassium nitrate
are dispersed; and
contacting the person's teeth with the dental bleaching composition for a time
period in order that the dental bleaching composition whitens the person's teeth and
in order that the potassium nitrate enhances the tooth whitening effect of the dental
bleaching agent and reduces tooth sensitivity that may be caused by the dental
bleaching agent.

19. A method for whitening and desensitizing a person's teeth as defined in
claim 18, wherein the person's teeth are contacted with the dental bleaching composition for
at least about 15 minutes.

20. A method for whitening and desensitizing a person's teeth as defined in
claim 18, wherein the person's teeth are contacted with the dental bleaching composition for
at least about 1 hour.

ABSTRACT OF THE DISCLOSURE

Composition and methods which include a dental bleaching agent and potassium nitrate for enhanced whitening and reduced tooth sensitivity. The potassium nitrate both enhances the whiteness of teeth beyond the whitening effect of the dental agent and reduces or eliminates tooth sensitivity that would otherwise be caused by the bleaching agent. For prolonged treatment of teeth, lower quantities of potassium nitrate (*e.g.*, 0.5%) have actually been found to work better than larger quantities (*e.g.*, 3%). The dental compositions may be applied directly to the person's teeth, or they may be loaded into a comfortable fitting, flexible, thin-walled dental tray and placed over the person's teeth. In that case, the dental compositions will include a tackifying agent, such as carboxypolymethylene, which assists the composition in retaining the dental tray over the person's teeth as a result of the adhesive properties of the dental composition rather than due to mechanical interlocking of the tray over the person's teeth. The dental compositions may further include anticariogenic and antimicrobial agents.

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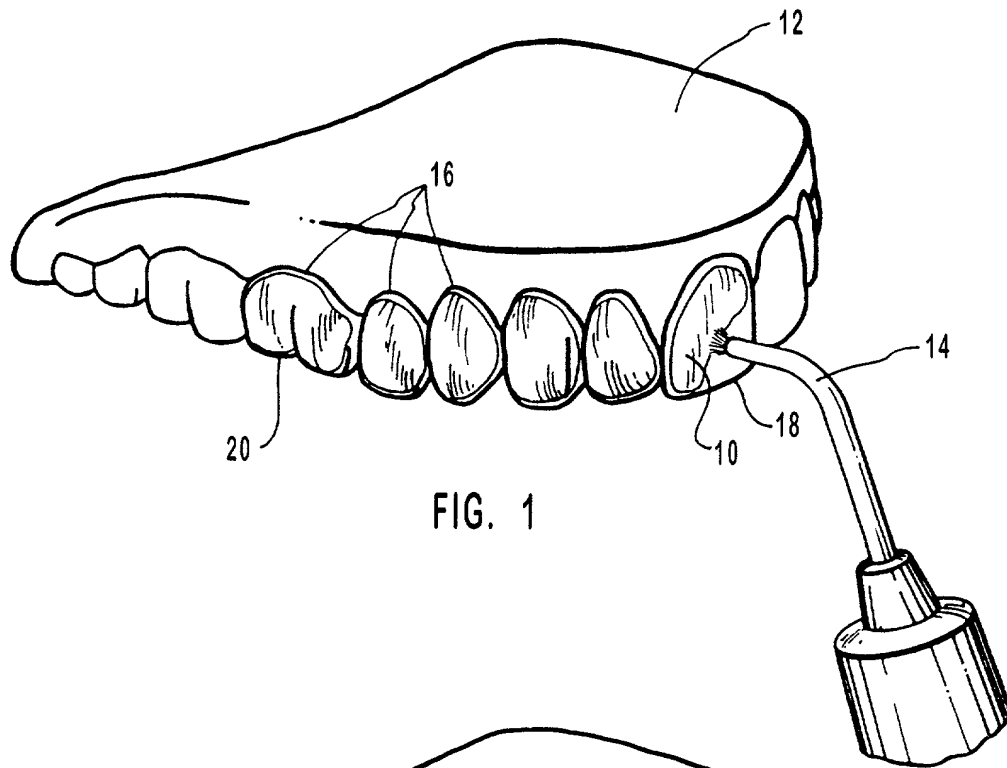


FIG. 1

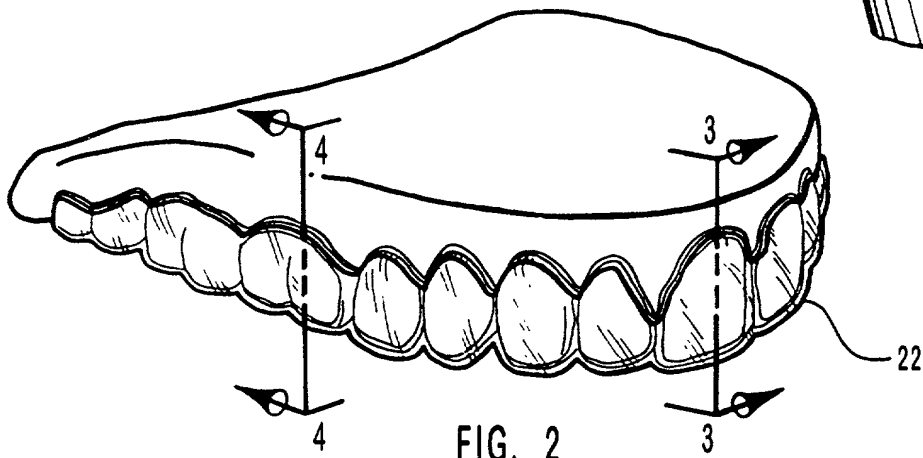


FIG. 2

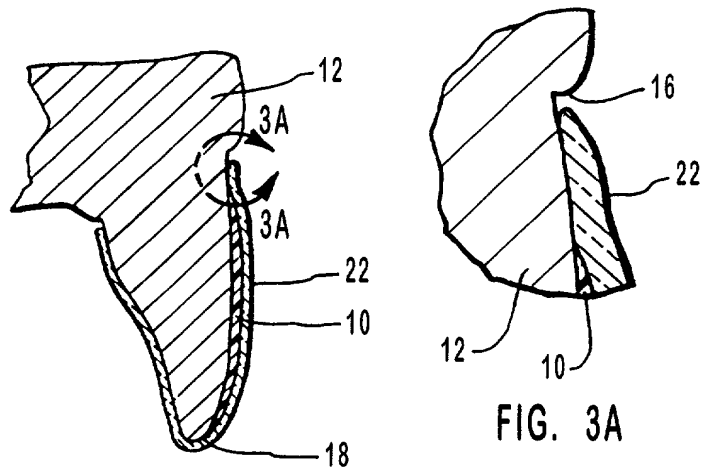
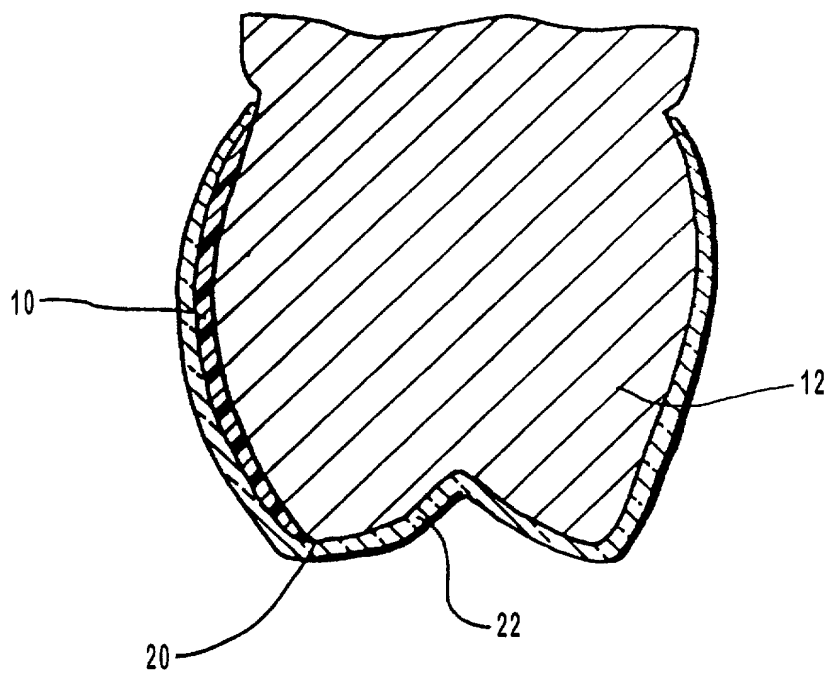


FIG. 3

FIG. 3A



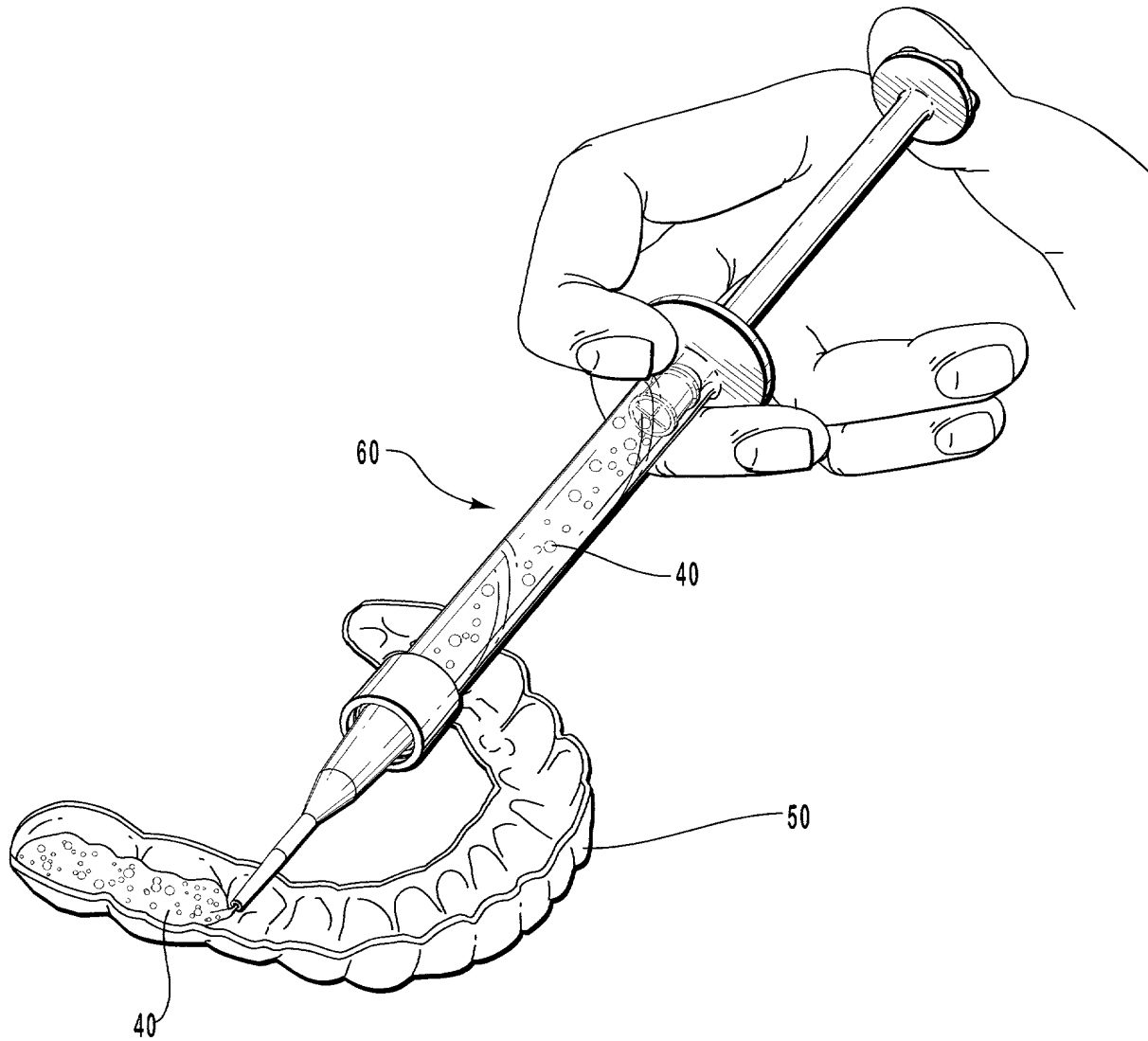


FIG. 5

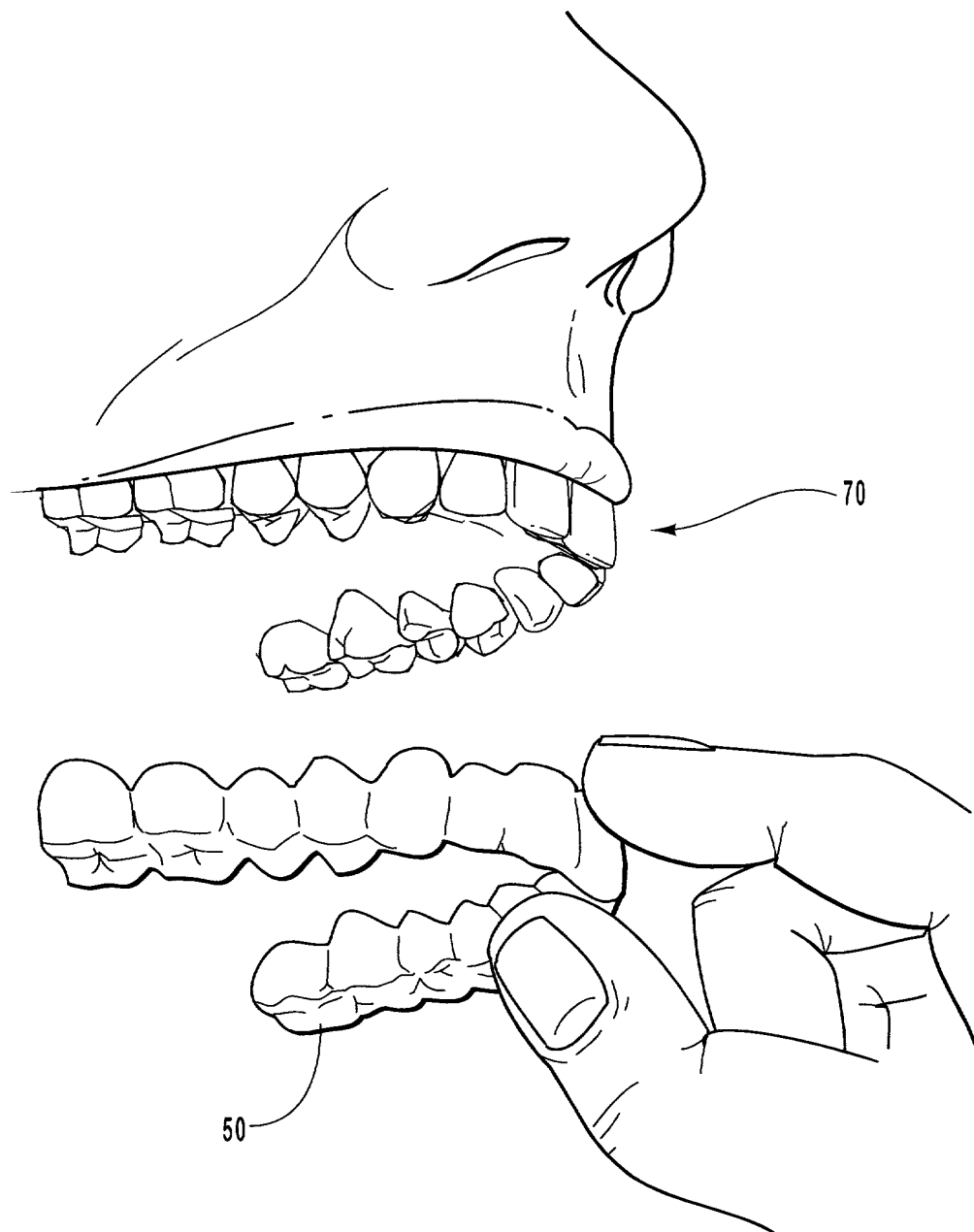


FIG. 6

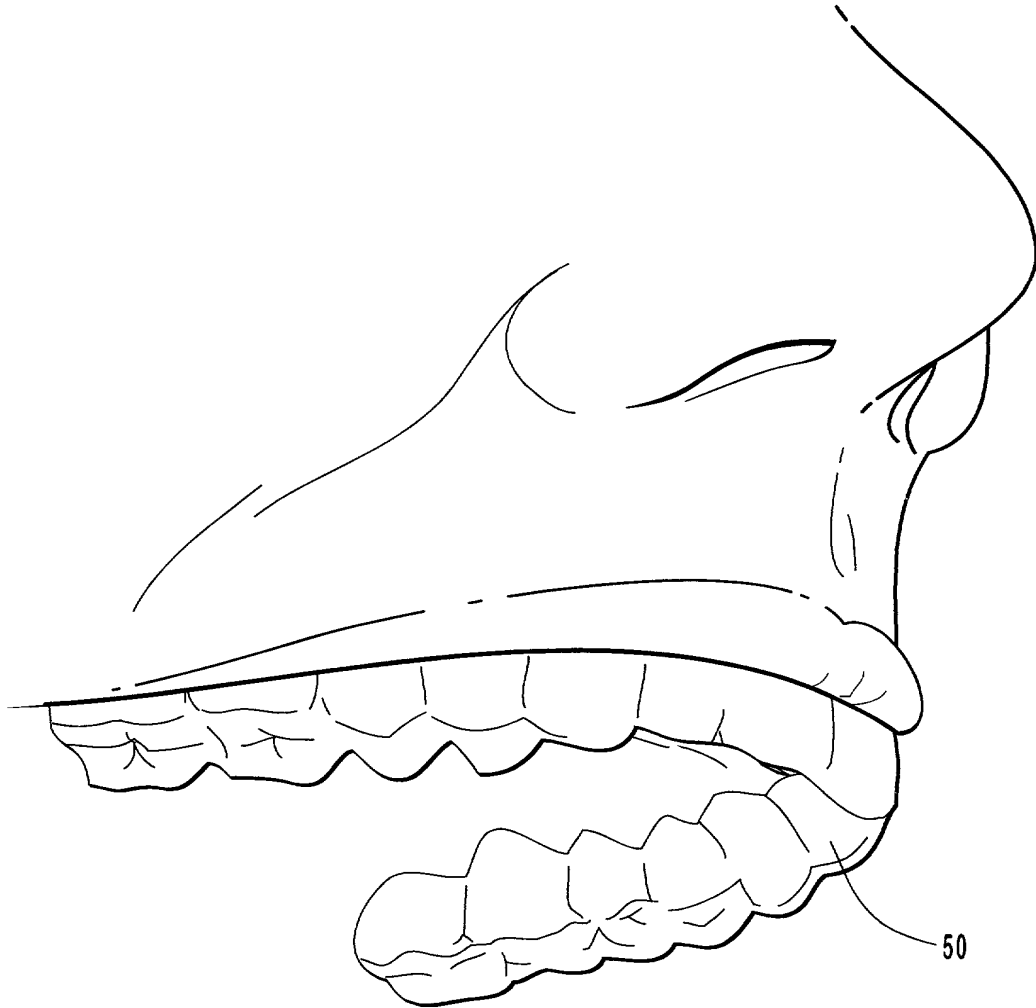


FIG. 7

DECLARATION, POWER OF ATTORNEY, AND PETITION

We, Steven D. Jensen and Dan E. Fischer, D.D.S., declare: that we are citizens of the United States of America; that our residences and post office addresses are 1190 West Chavez Drive, South Jordan, Utah 84095; and 1044 South Dimple Dell Road, Sandy, Utah 84093, respectively; that we verily believe we are the original, first, and joint inventors of the subject matter of the invention or discovery entitled COMPOSITIONS AND METHODS FOR WHITENING AND DESENSITIZING TEETH for which a patent is sought and which is described and claimed in the specification attached hereto; that we have reviewed and understand the contents of the above-identified specification, including the claims referred to, and that we acknowledge the duty to disclose information which is material to the examination of this application in accordance with Section 1.56(a) of Title 37 of the Code of Federal Regulations.

We hereby claim the benefit under Section 120 of Title 35 of the United States Code of the following earlier filed pending applications: Serial No. 09/190,709, filed November 12, 1998 and Serial No. 09/494,113, filed January 31, 2000; and, insofar as the subject matter of each of the claims of this application is not disclosed in the earlier filed pending application in the manner provided by the first paragraph of Section 112 of Title 35 of the United States Code, we acknowledge the duty to disclose material information, as defined in Section 1.56(a) of Title 37 of the Code of Federal Regulations, which occurred between the filing date of the earlier filed application and the filing date of this application.

We declare further that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these

statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful, false statements may jeopardize the validity of the application or any patent issuing thereon.

We hereby appoint as our attorneys and/or patent agents: RICK D. NYDEGGER, Registration No. 28,651; DAVID O. SEELEY, Registration No. 30,148; JONATHAN W. RICHARDS, Registration No. 29,843; JOHN C. STRINGHAM, Registration No. 40,831; BRADLEY K. DeSANDRO, Registration No. 34,521; JOHN M. GUYNN, Registration No. 36,153; CHARLES L. ROBERTS, Registration No. 32,434; GREGORY M. TAYLOR, Registration No. 34,263; DANA L. TANGREN, Registration No. 37,246; KEVIN B. LAURENCE, Registration No. 38,219; ERIC L. MASCHOFF, Registration No. 36,596; C. J. VEVERKA, Registration No. 40,858; ROBYN L. PHILLIPS, Registration No. 39,330; RICHARD C. GILMORE, Registration No. 37,335; DAVID B. DELLENBACH, Registration No. 39,166; KEVIN K. JOHANSON, Registration No. 38,506; DAVID L. GRIFFIN, Registration No. 44,136; R. BURNS ISRAELEN, Registration No. 42,685; DAVID R. TODD, Registration No. 41,348; FRASER D. ROY, Registration No. P-45,666; CARL T. REED, Registration No. P-45,454; JESÚS JUANÓS i TIMONEDA, Registration No. 43,332; STEPHEN D. PRODNUK, Registration No. 43,020; R. PARRISH FREEMAN, JR., Registration No. 42,556; PETER F. MALEN, JR., Registration No. P-45,576; ADRIAN J. LEE, Registration No. 42,785; KYLE H. FLINDT, Registration No. 42,539; ERIC M. KAMERATH, Registration No. 46,081; and WILLIAM J. ATHAY, Registration No. 44,515, with full power of substitution and revocation, to prosecute this application and to transact

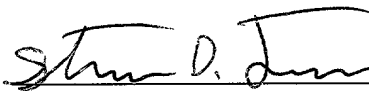
all business in the Patent and Trademark Office connected therewith. All correspondence and telephonic communications should be directed to:

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Wherefore, we pray that Letters Patent be granted to us for the invention or discovery described and claimed in the foregoing specification and claims, declaration, power of attorney, and this petition.


Signed at South Jordan, Utah, this 6th day of November 2000.

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